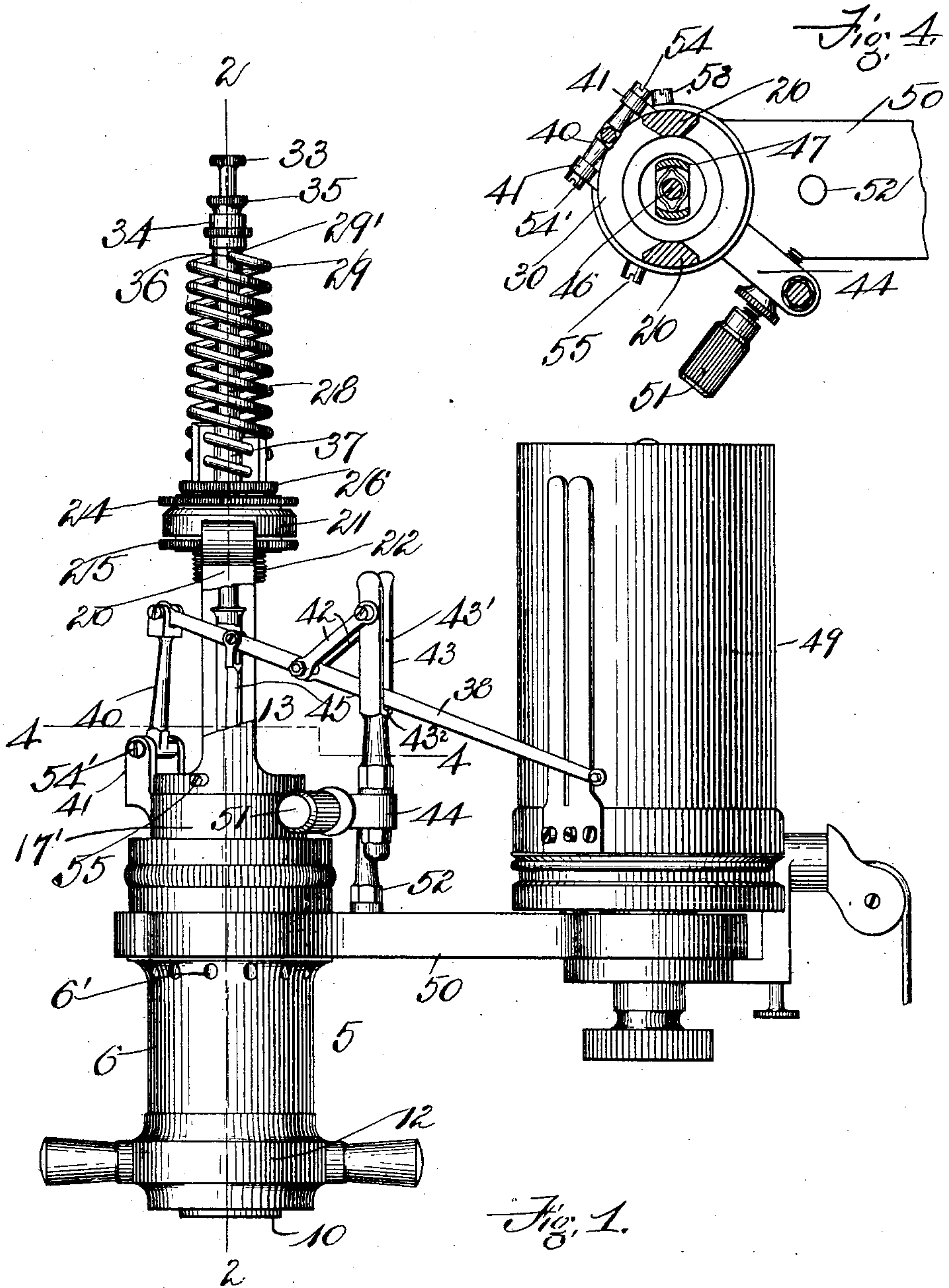


No. 861,490.

PATENTED JULY 30, 1907.

G. A. WEBSTER.  
STEAM ENGINE INDICATOR.  
APPLICATION FILED NOV. 21, 1906.

2 SHEETS—SHEET 1.



Witnesses:

H. A. Hall

Walter L. Pierce by his attorney,

Inventor:

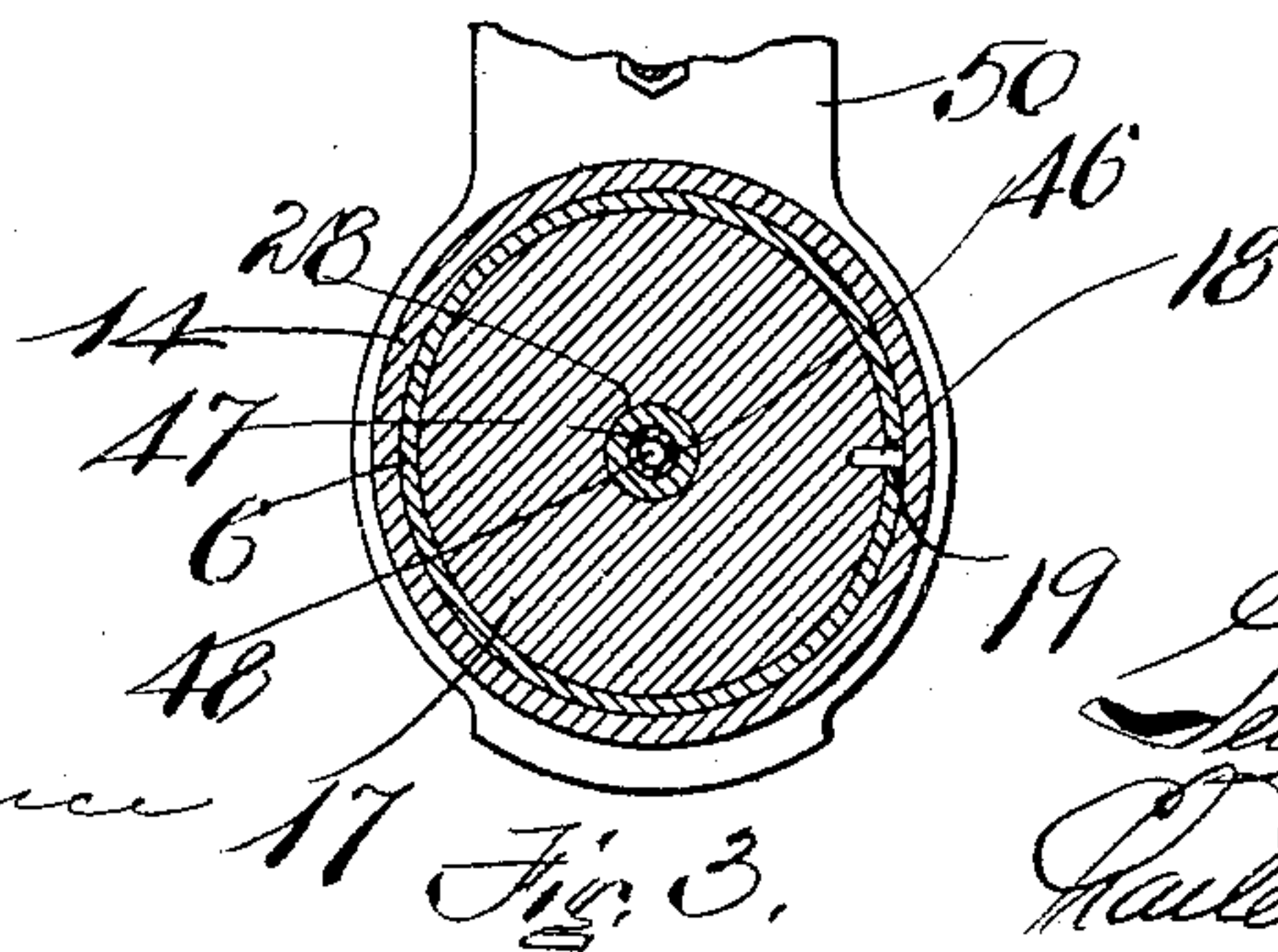
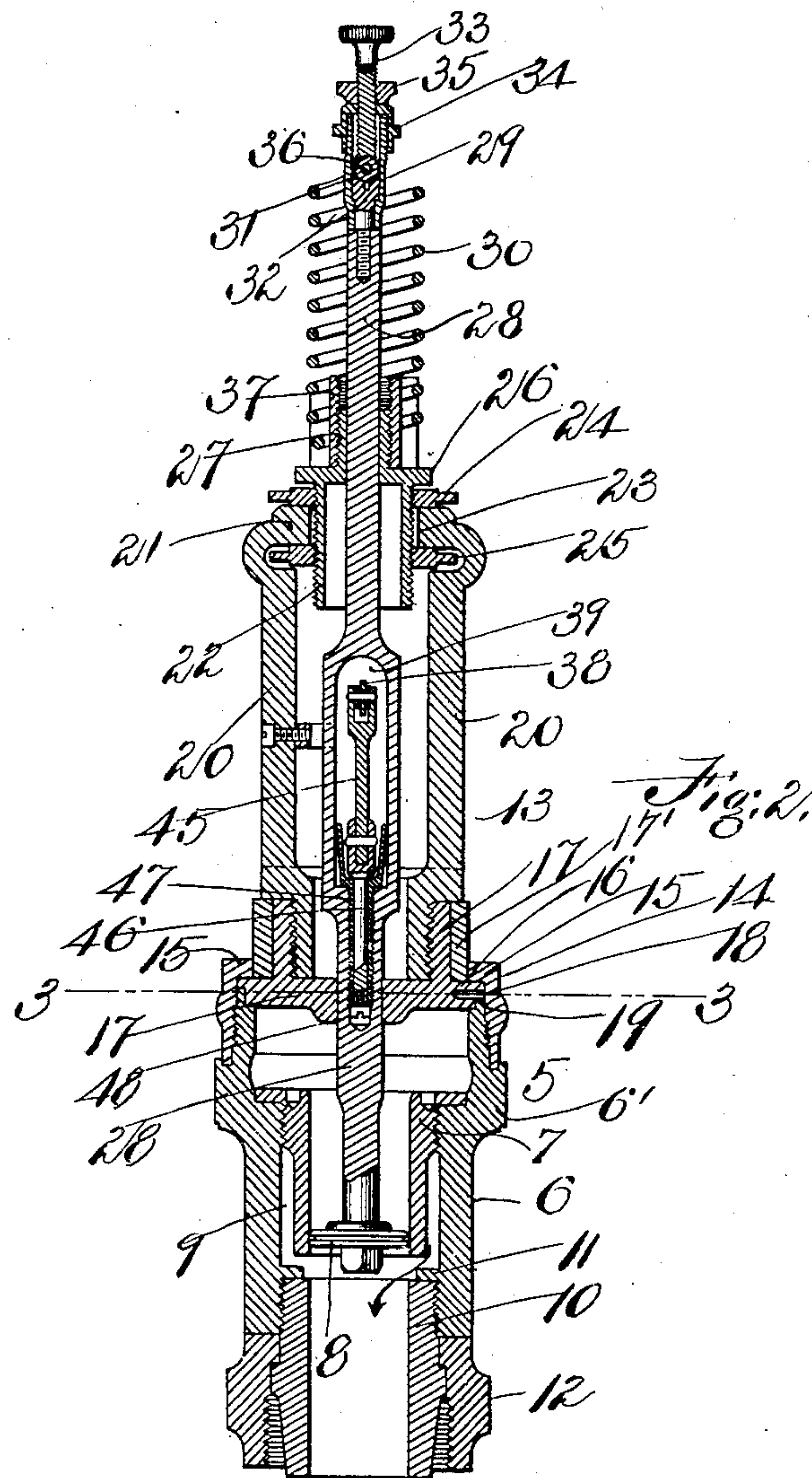
George A. Webster,  
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2 SHEETS—SHEET 2.



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H. A. Hall  
Walter T. Pierce

Inventor:

George A. Webster  
by his attorney,  
Paul S. Gooding.



# UNITED STATES PATENT OFFICE.

GEORGE A. WEBSTER, OF SOMERVILLE, MASSACHUSETTS, ASSIGNOR TO STAR BRASS MANUFACTURING CO., OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

## STEAM-ENGINE INDICATOR.

No. 861,490.

Specification of Letters Patent.

Patented July 30, 1907.

Application filed November 21, 1906. Serial No. 344,414.

*To all whom it may concern:*

Be it known that I, GEORGE A. WEBSTER, a citizen of the United States, residing at Somerville, in the county of Middlesex and State of Massachusetts, have  
5 invented new and useful Improvements in Steam-Engine Indicators, of which the following is a specification.

This invention relates to improvements in engine indicators of the outside spring type.

10 The novel features of my invention consist first, in the manner in which the piston and pencil mechanism, together with the outside spring, can be removed from the cylinder so that the latter can be cleaned, second,  
15 in the means for adjusting or changing the pencil mechanism in order to bring the pencil to the correct height to coincide with the atmospheric line upon the indicator card, third, in the means for limiting the downward movement of the pencil lever, and fourth, in the manner  
20 in which the spring may be detached from the device without changing the adjustment of the pencil mechanism or the adjustment of the pencil to the atmospheric line.

The object of the invention is to provide a device of the character set forth possessing the novel features  
25 hereinbefore recited, and further

To provide an engine indicator in which the cylinder is surrounded by steam or gas in the operation of the device, so that the conditions of expansion are always the same during the operation of the piston, the  
30 construction being such that said steam or gas has a ready outlet therefrom.

The object of the invention is still further to provide a device of the character set forth which may be readily changed from right to left, as hereinafter described,  
35 and in which the piston spring can be readily removed and replaced without deranging any of the adjustments of the device as a whole.

The invention consists in the combination and arrangement of parts set forth in the following specification and particularly pointed out in the claims thereof.  
40

Referring to the drawings: Figure 1 is a front elevation of my improved engine indicator, broken to more clearly illustrate the same. Fig. 2 is a sectional elevation taken on line 2—2, Fig. 1. Fig. 3 is a sectional  
45 plan taken on line 3—3, Fig. 2. Fig. 4 is a sectional plan taken on line 4—4, Fig. 1.

Like numerals refer to like parts throughout the several views of the drawings.

50 In the drawings, 5 is the indicator cylinder consisting of an outer jacket or casing 6 into which is screwed the inner casing 7 in which the piston 8 is adapted to reciprocate. An annular space 9 surrounds the inner

casing 7 so that the same is kept at substantially the same temperature during the operation of the device. A sleeve 10 has screw-threaded engagement with the  
55 interior of the lower end of the casing 6 and is screwed against an annular rib 11 integral with said outer casing. The sleeve 10 is conical at its lower end and has rotatably supported thereon a coupling 12 interiorly screw-threaded to engage the pipe leading from the engine  
60 cylinder. By screwing down upon the coupling 12 the conical shaped lower end of the sleeve 10 is forced into said pipe forming a tight fit. The annular chamber 9 communicates at its lower end with the interior of the sleeve 10, so that any steam or gas in said annu-  
65 lar chamber will flow downwardly therefrom into the interior of the sleeve 10 and thus into said pipe. The interior of the cylinder 5 communicates with the atmosphere by means of ports 6'. A standard 13 is fastened to the top of the cylinder 5 by a coupling 14 which has  
70 screw-threaded engagement with the outer casing 6 of the cylinder 5 and is provided with an inwardly extending rim 15 which projects over a flange 16 formed upon the base 17 of said standard 13. A "feather" or key 18 projects into a notch 19 formed in the upper  
75 edge of the cylinder casing 6 in order to prevent the standard from rotating relatively to said cylinder.

The standard 13 consists of the base 17, two arms 20, 20 which extend upwardly from said base, and a top 21 integral with the upper ends of said arms. A screw-  
80 threaded sleeve 22 projects through a hole 23 in said top, but does not have screw-threaded engagement therewith. Two nuts 24 and 25 have screw-threaded engagement with said sleeve above and below the top of  
85 said standard, respectively. The sleeve 22 is preferably provided with a flange 26 and above this flange 26 projects a stem 27 also exteriorly screw-threaded.

A piston-rod 28 is fastened at its lower end to the piston 8 and projects upwardly therefrom through the cylinder 5, having sliding engagement with the base  
90 17 of the standard 13 and extending still farther upwardly said piston rod has sliding engagement with the sleeve 22. The piston-rod 28 extends beyond the upper end of the stem 27 and has a swivel top 29 rotatably supported upon its upper end. The swivel top 29 is  
95 slotted at 29' to receive the upper end of a spring 30 which is bent between its ends and provided with a spherical enlargement or ball 31 which rests upon the top of a screw 32, said screw 32 being provided with a spherical depression in its head to receive said ball. 100  
The screw 32 rotatably connects the swivel top 29 with the piston rod 28. The spring 30 is held against the screw 32 by a set-screw 33 which has screw-threaded engagement with a cap 34 which, in turn, has screw-



threaded engagement with the swivel top 29. The cap 34 is locked to said swivel top by a set-nut 35 having screw-threaded engagement with the set-screw 33. The central portion of the spring 30 is bent to form the cross-bar 36 which extends across the piston rod in the slot 29' and said spring is then wound to form a double spring extending downwardly from the cross-bar 36 around the piston rod 28, the two lower ends of said spring being fastened to a collar 37 which has screw-threaded engagement with the stem 27 upon the upper end of the sleeve 22.

The pencil lever 38 extends through an opening 39 in the piston rod 28 and is pivoted at its rear end to a rocker arm 40 which, in turn, is pivoted to ears 41 formed upon the collar 17' which is adapted to rotate upon the base 17. Said rocker-arm is connected by links 42, 42 to a bifurcated post 43, which post is rigidly fastened to an ear 44 upon the collar 17'. The pencil lever 38 is connected by a link 45 to the upper end of a swivel stud 46. The swivel stud 46 is rotatably supported in and extends downwardly through a sleeve 47 having screw-threaded engagement with the piston-rod 28. The lower end of the stud 46 has a screw 48 fast thereto, the head of said screw being of sufficient diameter to project across the lower end of the sleeve 47, thus preventing the stud 46 from being withdrawn or from moving longitudinally in said sleeve.

In the practical operation of engine indicators in which the pencil mechanism is of substantially the arrangement and construction hereinbefore described, it has been found that under certain conditions the pencil lever 38 descends to a position where the links 42 lock the lever in its lowermost position—that is, the lever descends to a point where the pivots of the links form a dead center, so that when the initial pressure of the steam or gas is imparted to the piston 8, the pencil lever is locked against upward movement and is very frequently broken. To overcome this objection and to prevent the lever 38 from descending to such a position that the links 42 will lock said lever against upward movement, thus causing the breakage hereinbefore referred to, the pencil lever 38 is extended through the slot 43' in the bifurcated post 43 and the bottom 43<sup>2</sup> of said slot forms a stop to limit the downward movement of said pencil lever. By this construction the freedom of movement of the pencil lever in its normal operation is not in any way interfered with and the extreme downward movement of the pencil lever is eliminated, so that the links 42, 42 cannot, in its lowermost position, lock said pencil lever against upward movement with the disastrous results hereinbefore set forth.

The drum 49, to which the indicator card is attached, is rotatably supported upon an arm 50 fast to the outer cylinder casing 6. The stop-screw 51 is screwed into the ear 44 and bears at its rear end against a stop 52 fast to the arm 50. By screwing upon the stop-screw 51 in the proper direction, the pencil may be regulated to bear as desired against the drum when the pencil is thrown forward until the stop-screw engages the stop post 52.

When the pencil lever is moved away from the drum 49 by rotating the collar 17' and the parts supported thereon, together with the pencil mechanism, the distance to which said collar can be rotated is limited by

a stop-screw 53 fast to said standard, against which the screw 54, fast to one of the ears 41, abuts when the parts are in the position illustrated in Fig. 4. A screw 55 forms a similar stop to limit the rotation of the collar 17' and the parts supported thereon when the pencil mechanism is reversed, as hereinafter described, to take a left hand card.

The operation and manner of adjustment of my improved engine indicator is as follows: The steam or gas enters the interior of the cylinder and forces the piston 8 and piston rod 28 upwardly, thus expanding the spring 30 which is constantly acting to force said piston rod and piston downwardly. As the piston rod is raised the stud 46 and link 45 will be raised, thus moving the pencil arm upwardly to indicate an increase of pressure in the cylinder, the spring 30 forcing the piston downwardly which through the stud 46 and link 45 communicates a downward movement to the pencil lever. To remove the spring 30 the set-nut 35 is loosened and the cap 34 unscrewed from the upper end of the swivel top 29. The collar 37, with the spring 30 fast thereto, is then unscrewed from the stem 27. To adjust the pencil arm until the pencil is in alinement with the atmospheric line the nuts 24 and 25 are manipulated to raise or lower, as may be desired, the screw-threaded sleeve 22 upon the top of the standard 13. This is done, for instance, by loosening the lower nut 25 and tightening the upper nut 24, thus causing the screw-threaded sleeve 22 to be raised and the pencil likewise to be raised until it is brought to the atmospheric line, or the upper nut 24 may be loosened, thus allowing the sleeve 22 to be moved downwardly, together with the piston-rod 28, by the spring 30 and the pencil point will thus be moved downwardly until it is brought to the atmospheric line, the sleeve finally being locked in position by tightening the nut 25.

If it is desired to remove the piston from the cylinder in order to clean the same or for whatever purpose it may be desired to separate said parts, the coupling 14 is unscrewed from the upper end of the cylinder outer casing 6, whereupon the piston may be removed from the cylinder 5 by withdrawing the same from the inner casing 7, it being understood that the piston rod 28, standard 13, the pencil mechanism and the spring 30, together with their adjusting and supporting parts, will also be simultaneously removed from connection with said cylinder.

In the drawings my improved indicator is shown with the parts arranged to take a right hand card, or as a right hand instrument. If it is desired to change the same so as to take a left hand card, thus changing the indicator to a left hand instrument, the drum 49 is removed by a straight upward pull and a stop-screw changed from one hole to another in a manner well known to those skilled in this art, said stop-screw not being shown in the drawings. The pencil motion is reversed by changing the metallic pencil point in the pencil lever 38 and by reversing the stop-screw 51 in the ear 44. The collar 17' and the parts supported thereon are then moved to the opposite side of the post 52 so that the stop-screw 51 will strike against the rear side of the stop-post 52 (Fig. 4) instead of on the front side. This brings the pencil upon the opposite side of the drum from that viewed in Fig. 1 and the instrument is then ready to take a left hand card. The screw 54' will



then abut against the stop-screw 55 to limit the distance to which the collar 17' and the pencil mechanism can be swung away from the stop post 52 and drum 49.

Having thus described my invention, what I claim and desire by Letters Patent to secure is:

1. In an engine indicator, a cylinder, a standard having a base rigidly fastened thereto, a piston and piston rod, said piston rod adapted to slide in said base, a pencil mechanism rotatably supported on said base, and means to detachably fasten said standard to said cylinder.
2. In an engine indicator, a cylinder, a standard having a base rigidly fastened thereto, a piston and piston rod, said piston rod adapted to slide in said base, a pencil mechanism rotatably mounted on said base, and means to clamp said base to said cylinder.
3. In an engine indicator, a cylinder, a standard having a base rigidly fastened thereto, a piston and piston rod, said piston rod adapted to slide in said base, a pencil mechanism rotatably mounted on said base, and a coupling sleeve having screw-threaded engagement with said cylinder and constructed to engage said base and clamp the same to said cylinder.
4. In an engine indicator, a cylinder, a standard having a base rigidly fastened thereto, a piston and piston rod, said piston rod adapted to slide in said base, a pencil mechanism rotatably mounted on said base, means to lock said base against rotation upon said cylinder, and means to clamp said base to said cylinder.
5. In an engine indicator, a cylinder, a piston and piston rod, a pencil mechanism operatively connected to said piston rod, a standard upon which said pencil mechanism is supported, a screw-threaded sleeve projecting through the top of said standard and slidable therein, a pair of nuts having screw-threaded engagement with said sleeve above and below said top, respectively, and a spring, the lower end thereof supported on said sleeve, the upper end thereof connected to said piston rod.

6. In an engine indicator, a cylinder, a piston and piston rod, a pencil mechanism operatively connected to said piston rod, a standard upon which said pencil mechanism is supported, a screw-threaded sleeve projecting through the top of said standard and slidable therein, a pair of nuts having screw-threaded engagement with said sleeve above and below said top, respectively, a collar having screw-threaded engagement with said sleeve, and a spring, the lower end of said spring bearing against said collar, the upper end thereof rotatably connected to said piston rod.

7. In an engine indicator, a cylinder, a piston and piston rod, said piston rod having a swivel top, a pencil mechanism operatively connected to said piston rod, a standard upon which said pencil mechanism is supported, a screw-threaded sleeve projecting through the top of said standard and slidable therein, a pair of nuts having screw-threaded engagement with said sleeve above and below said top, respectively, a collar having screw-threaded engagement with said sleeve, and a spring, the lower end of said spring bearing against said collar, the upper end thereof connected to said swivel top.

8. In an engine indicator, a cylinder, a piston and piston rod, a pencil mechanism operatively connected to said piston rod, said pencil mechanism comprising in its construction a pencil lever, a bifurcated post located between said piston rod and the free end of said pencil lever, and a pair of links pivoted at their opposite ends, respectively, to said bifurcated post and to said pencil lever, said pencil lever projecting through the slot of said bifurcated post, the bottom of said slot forming a stop to limit the downward movement of said lever in the operation of the device.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

GEORGE A. WEBSTER.

Witnesses:

CHARLES S. GOODING,  
LOUIS A. JONES.